

The logo features a red circle with several concentric yellow circles around it. Yellow arrows radiate from the top of the red circle, and several yellow curved arrows point towards the bottom of the red circle. The text "ENERGY CENTER OF WISCONSIN" is written in white capital letters across the middle of the logo.

ENERGY CENTER OF WISCONSIN

Proposed Market Screen for Assessing Achievable Potential for Energy Efficiency In Wisconsin

Summary Prepared by
Energy Center of Wisconsin

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Direct questions or comments to:
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Achievable Potential for Energy Efficiency in Wisconsin

1. Market Screening Summary and Recommendations

Through a process of meetings, written comments, and consultations, the Energy Center of Wisconsin proposed 36 markets to study to determine the potential for achievable energy efficiency and renewable energy in the state of Wisconsin. This approach focuses on market opportunities (top-down) rather than end-uses (bottom-up). The Energy Center believes that this approach will yield the richest data for both estimates of quantitative potential as well as qualitative information on program design and behavioral barriers to achieving energy efficiency.

To determine whether these proposed markets constitute a significant amount of energy efficiency potential in the electric and natural gas markets, the Advisory Committee¹ asked that the Energy Center compare this list of markets for energy efficiency with those represented by other recent comparable studies. Because no two studies are exactly alike, we reviewed several studies and selected the most recent comparable studies to benchmark the Residential and Commercial and Industrial markets. (We were not directed to do benchmarking of the renewable markets.)

This report summarizes the results of the screening and recommends some minor substitutions and adjustments to the markets. For all markets, we conclude that the proposed markets, with minor adjustments, reflect a substantial portion of the total achievable energy efficiency potential in Wisconsin. Therefore we do not recommend any expansion of number of markets as it would not add information in proportion to the cost of studying the additional markets.

The specific changes recommended are as follows:

Commercial and Industrial: Combine the two New Construction markets into a single market so that the industrial motor end of service replacement market could be added; add lighting replacement to the commercial alterations (lighting remodeling) and expand to include industrial; and add industrial to the commercial lighting retrofit market.

Residential: Delete 1-4 unit rental remodeling, 1-4 unit rental refrigerator purchase, and 5+ unit refrigerator purchase. In the place of these markets, substitute:

- Retrofit Homeowner building shell improvements (This market considers program approaches to encourage homeowners to undertake building shell improvements for space heating and cooling savings. It does not cover improvements undertaken as part of home remodeling, which are considered separately in Market #25.)

¹ This committee was appointed by the Governor's Task Force on Energy Efficiency and Renewable Energy to provide oversight to the study.

- Retrofit Rental fuel switching (This market embraces programs to encourage the conversion of rental housing with electric space heating or water heating to gas-fired systems.)
- Incremental/Retrofit Dehumidifier early retirement and upgrade on purchase. (This market involves program approaches to encourage homeowners to upgrade to higher efficiency dehumidifiers, or to retire working but inefficient dehumidifiers. It may also include the promotion of controls to reduce dehumidifier power draw during peak periods.)

A full list of markets with the proposed adjustments is included in the Appendices of this study.

These recommendations take into consideration the screening results as well as comments received from stakeholders and the Advisory Committee. **We ask that the Advisory Committee provide comments on the list of markets with the proposed adjustments by January 10.** E-mail comments are welcome from others at the same time with a copy to the Advisory Committee. Should there be disagreement about the changes or about the number of markets, the Energy Center will reconvene the Advisory Committee.

In order to keep the study momentum moving forward, the Energy Center staff is proceeding to develop the data needed for evaluation of markets that have not been “contested.”

2. Commercial, Industrial, Municipal, and Agricultural Sector Benchmarking Overview

To estimate the extent to which the 15 markets proposed in November 2004 for the energy efficiency potential study cover the total achievable potential for Wisconsin commercial, industrial, municipal, and agricultural energy efficiency opportunities, we benchmarked these markets against several recent comparable studies. These included:

- A 2003 study of achievable energy efficiency electric energy and demand potential for New York State, conducted for the New York State Energy Research and Development Authority (NYSERDA);
- A 2004 study of achievable energy efficiency electric energy potential in Connecticut;
- A 2004 study by the Northwest Energy Efficiency Alliance (industrial only)
- A 2004 study for the Energy Trust of Oregon
- The 2003 Puget Sound Energy Least Cost Plan

The criteria for selecting these studies were that: (a) they involved estimates of achievable potential—albeit generally without funding constraints; and (b) the commercial and industrial subsectors could be considered to be reasonably comparable to Wisconsin’s or readily adjusted if needed. We also included the prior Wisconsin Statewide Technical and Economic Potential (STEP) study in a more limited analysis of how various studies have allocated potential across end uses.

The analysis involved mapping the 15 proposed Wisconsin study markets to measures and end-uses defined for the studies, adjusting potential estimates for major differences in subsector weightings and, in one case (NYSERDA), adjusting the assumed achievable penetration of retrofit measures. While the process cannot be considered to be an exact one, it does provide at least a rough sense of how the proposed Wisconsin markets stack up against potential estimates from other studies.

In general, the results suggest that the 15 nonresidential markets proposed in November cover approximately 75 to 90 percent of the achievable energy efficiency potential, depending on the study and whether electric energy or electric demand are considered.

On the gas side, screening suggests that about 75% of achievable, cost effective commercial gas conservation is covered by the Wisconsin study, when insulation and window retrofit measures are not included in the overall potential. The level of cost-effective, achievable opportunity for insulation retrofits in commercial buildings in Wisconsin is questionable. To reach this percentage, we needed to include heating side measures in the Small HVAC System Maintenance market, and expand Boiler Replacement to Boiler System Improvements.

We found one study that provided results usable for industrial gas conservation screening, and it was neither comprehensive nor did it match up precisely with our markets. The study data is not available to make an accurate screening assessment, however, the Wisconsin Study will identify significant savings coming primarily from paper and food industry retrofits.

We also examined the impact on coverage of making changes suggested by Focus on Energy, WECC, and other stakeholders in comments on the November list of proposed markets. We adopted several suggestions that increased the coverage of the study. The final list of proposed nonresidential markets is provided in Appendix A.

In the following sections, we provide more detail about our analysis of the individual studies.

NYSERDA (Electric)

We used the NYSERDA study's 10-year achievable Greenhouse Gas (GHG) potential estimates for benchmarking against the proposed Wisconsin study. The achievable GHG scenario is not really *achievable* in the sense of being grounded in program implementation scenarios. Rather, it is something more akin to theoretical maximum achievable potential, in that it recognizes market barriers to fully achieving technical or economic potential, but does not involve program spending constraints. The report acknowledges this perspective and notes the estimates are not to be used for explicit program planning.

NYSERDA COMMERCIAL

For the commercial sector analysis, we extracted the estimates from table 7.1.1, which provides energy and demand by measure and 9 commercial subsectors (office, retail, grocery, warehouse, education, health, lodging, restaurant, and other). Six emerging measures included in the NYSERDA study for the technical potential estimate were excluded from this analysis because of uncertainty that they could achieve significant adoption within the next 10 years:

- Within lighting, electrodeless lighting technologies and white LED arrays – emerging technologies that provided negligible savings in the NYSERDA study (<0.02%)
- Within HVAC, copper rotor motors, “Tier 4” unitary HVAC equipment, “Tier 2” chillers, and “Tier 2” glazing performance – these measures represent an efficiency level beyond that of current leading edge equipment. The reduction to savings total by excluding them is negligible (0.2%)

Another category of measures excluded from the analysis was energy efficient office equipment for new construction and replacements. Measures in the NYSERDA study were high efficiency computer display, CPU, printer, fax, and low mass copier. Office

equipment choices are made on multiple criteria, and energy intensity reductions can happen through naturally occurring technology evolution. To the extent the energy savings result from an intervention, national market transformation efforts such as EPA Energy Star programs would have high attribution. The reduction to the savings total by excluding these measures is small (4.0%). The achievable potential for unitary HVAC retrofit includes only those measure/subsector combinations that showed a positive benefit-cost ratio (only 23% of savings was positive).

These adjustments yielded a list of 1,306 line items across measure markets and subsector.

Wisconsin/NYSERDA Commercial Market Mapping

Proposed WI Commercial Market	NYSERDA measure (from Table 7.1.1)
High performance new building design and construction (excl. industrial process)	CFL - interior Indoor Lighting New construction
	Daylight Dimming Indoor Lighting New construction
	Fluorescent hi/lo bay fixture Indoor Lighting New construction
	HE fixtures/design Tier I Indoor Lighting New construction
	HE fixtures/design Tier II Indoor Lighting New construction
	Improved exterior lighting design Outdoor Lighting New construction
	LED exit sign Indoor Lighting New construction
	Occupancy hi/low Indoor Lighting New construction
	Occupancy on/off Indoor Lighting
	T8 fixture Indoor Lighting New construction
	EMS/Controls - New construction
	HE AC Tier I, II, and III Cooling New construction
	HE HP Tier I, II, and III Cooling side savings
	HE Chillers Cooling New construction
	High Performance Glazing - COOL Cooling New construction
	Optimized chiller distribution/control system - Cooling New construction
	Optimized unitary HVAC distribution/control sys Cooling New construction
	Premium Efficiency Motors Ventilation New construction
	VFD Ventilation New construction
	HE Ice Makers Refrigeration New construction
	HE Reach-Ins Refrigeration New construction
	HE Refrigeration Grocery Refrigeration New construction
	HE Transformers Total New construction
	Integrated Building Design Total New construction
	Commissioning Total New construction
Lighting potential lost opportunity markets (remodel, equipment replacement)	CFL - interior Indoor Lighting
	Daylight Dimming Indoor Lighting
	Fluorescent hi/lo bay fixture Indoor Lighting
	HE fixtures/design Tier I Indoor Lighting
	HE fixtures/design Tier II Indoor Lighting
	LED exit sign Indoor Lighting
	Occupancy hi/low Indoor Lighting
	Occupancy on/off Indoor Lighting
	T8 fixture Indoor Lighting
Lighting & lighting controls retrofit	CFL - interior Indoor Lighting
	Fluorescent hi/lo bay fixture Indoor Lighting
	HE fixtures/design Tier I Indoor Lighting

Proposed WI Commercial Market	NYSERDA measure (from Table 7.1.1)
	HE fixtures/design Tier II Indoor Lighting
	Improved exterior lighting design Outdoor Lighting Retrofit
	LED exit sign Indoor Lighting
	Occupancy on/off Indoor Lighting Retrofit
	Specular Reflectors Indoor Lighting Retrofit
	T8 lamp/ballast Indoor Lighting Retrofit
Unitary HVAC end of service replacement	HE AC Tier I, II, and III Cooling
Commercial boiler (>300,000 Btuh) end of service replacement	HE HP Tier I, II, and III Cooling side savings
Small HVAC system maintenance	NYSERDA study did not address gas measures
	Dual enthalpy control Cooling Retrofit
	Optimized unitary HVAC distribution/control sys Cooling
Chiller equipment efficiency and system improvements	Optimized chiller distribution/control system – Cooling
	EMS/Controls - COOL Cooling
	HE Chillers Cooling
Supermarket and packaged refrigeration	HE Reach-Ins Other Refrigeration
	Walk-in refrigeration retrofit package
	HE Ice Makers Refrigeration
	HE Vending Machine Refrigeration
	HE Refrigeration Retrofit
	Vending Miser Refrigeration Retrofit

Adjusted and mapped in this way, the NYSERDA study suggests that the proposed Wisconsin markets account for 76 percent of electric energy impacts and 81 percent of electric demand impacts:

Wisconsin/NYSERDA Commercial Market Mapping Summary

Proposed Wisconsin Market	% of NYSERDA Potential	
	Energy	Demand
High performance new building design and construction	8%	10%
Lighting potential lost opportunity markets (remodel, equipment replacement)	14%	11%
Lighting & lighting controls retrofit	37%	28%
Unitary HVAC end of service replacement	2%	6%
Small HVAC system maintenance	1%	5%
Chiller equipment efficiency and system improvements	5%	18%
Supermarket and packaged refrigeration	9%	3%
Total	76%	81%

The table below shows the measures and end-uses *not* covered by the proposed markets for the Wisconsin study:

Wisconsin/NYSERDA Commercial Market Mapping-Excluded Markets

NYSERDA Measures not included in WI markets	% of NYSERDA Potential	
	Energy	Demand
Ventilation System Optimization (motors, VFD, controls, EMS)	14%	2%
High Efficiency Unitary Equipment Retrofit (B/C>1)	2%	6%
Facility HVAC O&M retrocommissioning	4%	3%
High Performance Glazing	2%	5%

NYSERDA Measures not included in WI markets	% of NYSERDA Potential	
	Energy	Demand
HE HP Tier I, II, and III Heating side savings	<1%	<1%
Water Heating measures	<2%	<2%
Traffic Lights Retrofit	<1%	<1%
All other measures	<1%	1%
Total	24%	19%

NYSERDA INDUSTRIAL

For the industrial sector analysis, we extracted the estimates from table 7.1.1, which provides energy and demand by measure and 22 industry subsector (food, paper, primary metals, etc.). Two technical potential measures included in the NYSERDA study were excluded from this analysis because of uncertainty that they could achieve significant adoption within the next 10 years:

- Industrial electric supply system improvements – power quality improvements that reduce energy use
- Industrial advanced motor designs – switched reluctance and written-pole motors

These adjustments yielded a list of 471 line items across measures markets and subsector.

Wisconsin/NYSERDA Industrial Market Mapping

Proposed WI Industrial Market	NYSERDA measure (from Table 7.1.1)
High performance new building design and construction (excl. industrial process)	Ind Efficient lighting design
	Ind Efficient lighting fixtures and lamps
	Ind Advanced Cleanroom HVAC (Electronics)
	Ind Advanced Cleanroom HVAC (pharm)
	Ind Advanced Industrial HVAC
Unitary HVAC end of service replacement	No Measures in the NYSERDA Study
Lighting potential lost opportunity markets (remodel, equipment replacement)	No Measures in the NYSERDA Study
Lighting & lighting controls retrofit	Ind Efficient lighting design
	Ind Efficient lighting fixtures and lamps
Small HVAC system maintenance	No Measures
Motor end of service repair & replacement	Ind motor management
Compressed air system optimization	Ind Air Compressor Systems Advanced Controls
	Ind Compressed air system management
Fan system optimization	Ind Fan system efficiency
Pump system optimization	Ind Pump efficiency improvement
Manufacturing process retrofits	Ind Efficient refrigeration systems
	Ind Cooling and storage
	Ind Optimization of aeration systems – paper industry
	Ind Energy Information Systems – paper industry
	Ind Energy Management systems – paper industry
	Ind Sensors and controls – paper industry

Adjusted and mapped in this way in the table below, the NYSERDA study suggests that the proposed Wisconsin markets account for 65 percent of electric energy efficiency impacts, and 68 percent of electric energy efficiency demand impacts.

Wisconsin/NYSERDA Industrial Market Mapping-Summary

Proposed Wisconsin Industrial Market	% of NYSERDA Potential (original)	
	Energy	Demand
High performance new building design and construction (HVAC)	2%	2%
High performance new building design and construction (Lighting)	37%	43%
Lighting potential lost opportunity markets (remodel, equipment replacement)		
Lighting & lighting controls retrofit		
Unitary HVAC end of service replacement	NA	NA
Small HVAC system maintenance	NA	NA
Motor end of service repair & replacement	2%	2%
Compressed air system optimization	7%	6%
Fan system optimization	3%	3%
Pump system optimization	11%	9%
Manufacturing process retrofits	2%	2%
Total	65%	68%

The table below shows the industrial sector measures and end-uses *not* covered by the proposed markets for the Wisconsin study:

Wisconsin/NYSERDA Industrial Market Mapping--Excluded Markets

NYSERDA Measures not included in WI industrial markets	% of NYSERDA Potential	
	Energy	Demand
Ind Efficient Transformers (Tier 2)	1%	1%
Ind Energy Management systems	6%	6%
Ind Sensors and controls	2%	2%
Ind Duct/Pipe Insulation on process heating	22%	20%
All other measures	4%	3%
Total	35%	32%

Four measure categories are worth noting. The NYSERDA study had a strong emphasis on analyzing lighting measures, and this accounts for the relatively high proportion of lighting energy savings shown in the study compared with other studies. By contrast, manufacturing process retrofits and motor replacement total only 4% of the energy savings combined. Other than noting that process heating is 25% of base industrial energy usage, the NYSERDA study did not provide an end use breakdown on base energy usage. NYSERDA's industrial base is diverse but includes a large proportion of heavy manufacturing, lead by chemicals, primary metals, aluminum, and papermaking.

NYSERDA's baseline usage of 25% process heating compares with 10% for Wisconsin. As a result, a single duct and pipe insulation measure on process heating accounts for 22% of the NYSERDA energy savings. If this insulation measure were adjusted to reflect Wisconsin's industrial base, it would account for 9% of industrial savings rather than

22%. Adjusted to reflect Wisconsin industry in this way, the NYSERDA study suggests that the proposed Wisconsin markets account for 75 percent of electric energy impacts and 77 percent of electric demand impacts. The adjusted NYSERDA results are shown below.

Wisconsin/NYSERDA Industrial Market Mapping Summary (Adjusted)

Proposed Wisconsin Industrial Market	% of NYSERDA Potential (adjusted)	
	Energy	Demand
High performance new building design and construction (HVAC)	3%	3%
High performance new building design and construction (Lighting)	43%	49%
Lighting potential lost opportunity markets (remodel, equipment replacement)		
Lighting & lighting controls retrofit		
Unitary HVAC end of service replacement	NA	NA
Small HVAC system maintenance	NA	NA
Motor end of service repair & replacement	3%	2%
Compressed air system optimization	8%	7%
Fan system optimization	3%	3%
Pump system optimization	12%	10%
Manufacturing process retrofits	3%	2%
Total	75%	77%

NYSERDA MUNICIPAL

The NYSERDA study treats the various efficiency measures for municipal water and wastewater as a single measure with average impacts. Municipal water and wastewater treatment facility system optimization includes replacing coarse-bubble aeration with fine-pore aeration, proper pump sizing, impeller trimming, addition of pony pump for smaller loads or VFD, leak reduction, and better O&M practices. Energy savings reflects 15% average performance improvement. Existing practices include coarse-bubble aeration and oversized pumps with no VFD. The Wisconsin study will follow a similar approach.

NYSERDA AGRICULTURAL

The NYSERDA study combined agricultural production facilities, such as turkey processors, with family farms and included all the savings under within the industrial sector. The measure lists did not allow for separating farms from larger agri-business. The breakdown of cumulative energy savings for agriculture measures is provided below:

NYSERDA Agricultural Market Potential

NYSERDA Agriculture Measure Categories	% of NYSERDA Potential Energy (cumulative)
Lighting	40%
Pumps	56%
Fans systems	60%
Compressed Air	63%
Refrigeration	65%
Pipe and duct insulation	88%

Connecticut Energy Conservation Management Board (Electric)

The Connecticut Energy Conservation management Board provided estimates of economic achievable potential for electric energy and load savings documented in their report *Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region FINAL REPORT – June 2004*. The estimate covers all cost-effective (TRC) conservation achievable over a ten-year horizon.

Connecticut Commercial

We evaluated the 77 cost-effective measures presented in the CT ECMB study for new and existing commercial buildings. Adjusted and mapped to our markets, the CT ECMB study suggests that the proposed Wisconsin markets account for 89 percent of electric energy impacts, and 92 percent of electric demand impacts:

Wisconsin/Connecticut Commercial Market Mapping Summary

Proposed Wisconsin Market	% of CT ECMB Potential	
	Energy	Demand
Unitary HVAC end of service replacement	5%	7%
Lighting potential lost opportunity markets (remodel, equipment replacement on burnout)	11%	10%
Commercial boiler (>300,000 Btuh) end of service replacement	N/A	N/A
Lighting & lighting controls retrofit	41%	31%
Chiller system improvements	3%	8%
Small HVAC system maintenance	8%	20%
Supermarket and packaged refrigeration	13%	7%
New Building high performance building design and construction (excl. industrial process)	9%	8%
Total	89%	92%

The table below shows the commercial sector measures and end-uses *not* covered by the proposed markets for the Wisconsin study:

Wisconsin/Connecticut Commercial Market Mapping—Excluded Markets

CT ECMB Measures not included in WI markets	% of CT ECMB Potential	
	Energy	Demand
Dry Type Transformers	0%	0%
Packaged AC - 7.5 tons, Tier 2 - Early Replacement	1%	1%
Variable Speed Drive Control, 15 HP (Ventilation)	10%	2%
Total	11%	8%

We did not find any atypical results in the commercial study; however, we did exclude power management for office equipment from the analysis, for reasons previously discussed.

Connecticut Industrial

Connecticut industry is diverse, including plastics, papermaking, metals, and food processing, but also has significant printing, aerospace, medical instruments, pharmaceuticals, and machinery assembly. The study estimated the maximum achievable cost effective potential by 2012 at 723 GWh, or about 14% of total industrial energy consumption. The maximum achievable cost effective reduction in the 2012 load is estimated at 92.6 MW. The estimates provided in the comparison tables for this study are the maximum potential savings within a ten year horizon, regardless of cost.

The Connecticut study indicates that 27% of potential industrial energy savings in Connecticut were in HVAC. This is an atypical result compared with other potential studies we examined, and suggests that 3.8% of all industrial energy use could be saved through HVAC measures. This high percentage is due to the mix of industry in Connecticut that includes a significant share of climate-controlled manufacturing. The end-use share of HVAC in Connecticut industry is 12%. By comparison, the Wisconsin STEP study shows that only 3% of Wisconsin industrial energy is used for air conditioning and space heating. Other end uses are more comparable, although motors are 58% of energy in CT versus 69% for WI. To better reflect Wisconsin industry, “other HVAC” measures were reduced by a factor of 3/12, while motor measures were increased by a factor of 69/58.

Wisconsin/Connecticut Industrial Market Mapping

Benchmark Comparison – Industrial Electric Energy Markets				
CT Energy Conservation Mgt Board Industrial Markets	Savings (MWh)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
Motors Replacement	59,881	7%	7%	Industrial Motor End of Service Repair & Replacement
ASDs for Pumps and Fans	89,055	11%	19%	Pump and Fan Optimization
Pump System Measures	191,120	24%	42%	Pump system optimization
Fan System Measures	49,397	6%	49%	Fan system optimization
Compressed Air System Meas.	129,963	16%	65%	Compressed air system optimize.
Lighting	93,106	12%	76%	Lighting & lighting controls retrofit
Unitary HVAC replacement	13,623	2%	78%	Unitary HVAC replacement
Unitary HVAC tune-up	34,678	4%	83%	Small HVAC system maintenance
Paper & Refrigeration Process	9,721	1%	84%	Manufacturing process retrofits
Other HVAC	44,718	6%	89%	Not Covered
Transformers	6,605	1%	90%	Not Covered
62 Other Mfg Process Measures	79,082	10%	100%	Not Covered
Total Savings	800,949			

Wisconsin/Connecticut Industrial Market Mapping

Benchmark Comparison – Industrial Electric Summer Peak Reduction Markets				
CT Energy Conservation Mgt Board Industrial Markets	Savings (kW)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
Motors Replacement	10,474	10%	10%	Industrial Motor End of Service Repair & Replacement
ASDs for Pumps and Fans	1,567	1%	11%	Pump and Fan Optimization
Pump System Measures	34,385	31%	42%	Pump system optimization
Fan System Measures	7,980	7%	50%	Fan system optimization
Compressed Air System Meas.	24,188	22%	72%	Compressed air system optimize.
Lighting	10,252	9%	81%	Lighting & lighting controls retrofit
Unitary HVAC replacement	712	1%	82%	Unitary HVAC replacement
Unitary HVAC tune-up	1,813	2%	83%	Small HVAC system maintenance
Paper & Refrigeration Process	1,453	1%	85%	Manufacturing process retrofits
Other HVAC	1,227	1%	86%	Not Covered
Transformers	1,449	1%	87%	Not Covered
62 Other Mfg Process Measures	14,141	13%	100%	Not Covered
Total Savings	109,641			

Northwest Energy Efficiency Alliance (Industrial Electric)

The Northwest Energy Efficiency Alliance provided an estimate of economic electric energy savings potential documented in their report *Industrial Sector Initiative A Strategic Plan For Market Transformation in the Industrial Sector in the Pacific Northwest 2004-2009* (July 12, 2004, Northwest Energy Efficiency Alliance). The Pacific Northwest has a diversified industrial base with emphasis on papermaking, food processing, wood, and transportation equipment, similar to Wisconsin. The total industrial electric load is approximately 37.7 million MWh. The energy savings potential of 5.9 million MWh is approximately 15.6% of the industrial load. The NEEA estimate assumes 100% penetration of measures and not account for ramp in rates and achievable adoption levels.

Wisconsin/NEEA Industrial Market Mapping

Benchmark Comparison – Industrial Electric Energy Markets				
NEEA Industrial Markets	Savings (MWh)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
Motor Efficiency Upgrade	1,515,480	26%	26%	Industrial Motor End of Service Repair & Replacement
Motor Downsizing	367,920	6%	32%	
Rewind Improvements	280,320	5%	37%	
Pump System Efficiency	727,080	12%	49%	Pump system optimization
Fan System Efficiency	280,320	5%	54%	Fan system optimization
Compressed Air Systems	455,520	8%	62%	Compressed air system optimization
Lighting	508,080	9%	70%	Lighting & lighting controls retrofit
System Improvements: Process	543,120	9%	80%	Manufacturing process retrofits
Other Motors System Efficiency	473,040	8%	88%	Not Covered
O&M	727,080	12%	100%	Not Covered
NEEA Total Savings Potential	5,877,960	100%		

Energy Trust of Oregon (Commercial Gas)

The Energy Trust of Oregon provided an estimate of economic gas and electric energy savings potential documented in their report *Energy Efficiency and Conservation Measure Resource Assessment for the Residential, Commercial, Industrial and Agricultural Sectors* (January 2003, Energy Trust of Oregon, Inc.). Additionally, the majority of Oregon's commercial building stock is located in a fairly mild coastal-influenced climate zone. At a base temperature of 55 F, the heating degree days for Wisconsin versus Oregon are approximately double. The space heating savings are climate adjusted.

The Oregon study provided a comparatively broad range of gas conservation measures. As proposed, the markets selected for the Wisconsin Potential study cover two markets – boilers system improvements for space heating and rooftop HVAC system O&M. As shown below, these two markets would only cover 44% of the commercial gas saving potential, as shown below.

Wisconsin/Oregon Commercial Market Mapping

Benchmark Comparison – Commercial Gas Energy Markets				
Oregon Markets (Climate Adjusted)	Savings (Th/yr)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
Package Rooftop Measures	4,751,888	15%	15%	These are O&M measures and controls adjustments that are consistent with the Small HVAC System Maintenance market.
Boiler Equipment Replacement (space heat)	4,811,626	15%	29%	Commercial boiler (>300,000 Btuh) System Improvements
Boiler Controls and Commissioning Measures (space heat)	4,846,886	15%	44%	Commercial boiler (>300,000 Btuh) System Improvements
Gas Unit Heater Measures in Replacement	1,952,998	6%	50%	Not Addressed
Insulation Measures in Retrofit	12,809,872	39%	90%	Not Addressed
Windows Measures	406,834	1%	91%	Not Addressed
Hot Water Tank Measures in Replacement	330,286	1%	92%	Not Addressed
Hot Water Boiler Measures in Replacement	522,867	2%	94%	Not Addressed
Combo Boiler Measures in Replacement	156,471	0%	94%	Not Addressed
Hot Water Control Measures in Retrofit	1,640,606	5%	99%	Not Addressed
Cooking Appliance Measures in Replacement	258,503	1%	100%	Not Addressed
Total	32,488,837	100%		

According to the study, gas heating is the dominant form of space heating in the non-residential sector in Oregon. Nearly 100 percent of the buildings and building types that have been constructed over the last century are heated with natural gas. The majority of Oregon's commercial building stock is located in a fairly mild coastal climate zone. The use of insulation and other heat-conserving technologies was often not available or not thought to be cost effective when gas prices were quite low (for instance, in the middle of the twentieth century). For this reason, a substantial fraction of the commercial building

stock in Oregon is not insulated and provides a substantial energy savings resource pool for weatherization. The majority of savings and highest cost effectiveness for weatherization measures in the Oregon study are on uninsulated buildings. Window measures were largely not cost effective, or borderline at best.

The level of achievable opportunity for insulation retrofits in commercial buildings in Wisconsin is debatable. For comparison, we have removed insulation and windows measures from the study. The results are shown below.

Wisconsin/Oregon Commercial Market Mapping--Adjusted

Benchmark Comparison – Commercial Gas Energy Markets				
Oregon Markets (climate adjusted, building shell measures removed)	Savings (Th/yr)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
Package Rooftop Measures	4,751,888	25%	25%	These are O&M measures and controls adjustments that are consistent with the Small HVAC System Maintenance market.
Boiler Equipment Replacement (space heat)	4,811,626	25%	50%	Commercial boiler (>300,000 Btuh) system improvements
Boiler Controls and Commissioning Measures (space heat)	4,846,886	25%	75%	Commercial boiler (>300,000 Btuh) system improvements
Gas Unit Heater Measures in Replacement	1,952,998	10%	85%	Not Addressed
Hot Water Tank Measures in Replacement	330,286	2%	87%	Not Addressed
Hot Water Boiler Measures in Replacement	522,867	3%	89%	Not Addressed
Combo Boiler Measures in Replacement	156,471	1%	90%	Not Addressed
Hot Water Control Measures in Retrofit	1,640,606	9%	99%	Not Addressed
Cooking Appliance Measures in Replacement	258,503	1%	100%	Not Addressed
Total	19,272,131			

Puget Sound Energy Least Cost Plan

As part of its long-term resource strategy development, Puget Sound Energy (PSE) pursues a Least Cost Plan process. The primary purpose of this Least Cost Plan Update is to provide the results of a detailed assessment of the long-term conservation resource potential available. We used the August 2003 Least Cost Plan Update, developed in consultation with Commission staff and with public input.

Wisconsin/Puget Sound Industrial Market Mapping

Benchmark Comparison – Industrial Gas Energy Markets				
Washington Markets	Savings (Th/yr)	% of Savings	Cumul.	Wisconsin Potential Study Coverage
HVAC	667,332	15%	15%	Partially addressed by Small HVAC System Maintenance
Process Boiler - Steam Distribution System	2,055,527	46%	61%	Manufacturing Process Retrofits
Process Boiler – Process equipment	0	0%	61%	Manufacturing Process Retrofits
Process Boiler - Upgrade/Controls/Heat Recovery	1,038,582	23%	85%	Not Addressed
Process Boiler - O&M	685,176	15%	100%	Not Addressed
Total	4,446,617	100%		

We found one study, the Puget LCP, that provided results usable for industrial gas conservation screening, and it was neither comprehensive nor did it match up precisely with our markets. The study data is not available to make an accurate screening assessment, however, the Wisconsin Study will identify significant savings coming primarily from paper and food industry process retrofits.

End-Use Comparison

As an overall comparison, we examined how the potential estimated for the various breaks out by major end-use. For this comparison, we added the 1995 Wisconsin Statewide Technical and Economic Potential study. Although the prior Wisconsin study does not address achievable potential, it is a local potential study that provides potential estimates by end-use.²

The tables below show how electric energy, electric demand, and gas savings potential break out by end-use for each study. Comparisons are tricky, because the studies did not all consider the same end uses, and subsector weightings are different.

In the commercial comparison, the results for both NYSERDA and CT ECMB studies were adjusted to remove energy efficient office equipment and office equipment power management. The end-use breakouts for the commercial studies for NY and CT are quite similar to the STEP study.

Commercial Electric Energy Efficiency Potential by End-Use and Study

	CT (adj)	NY (adj)	WI STEP
Lighting	52%	56%	58%
Air Conditioning		11%	13%
Space Heat	27%	0%	14%
Ventilation		15%	3%
Refrigeration	13%	10%	2%
Other	8%	8%	9%
	100%	100%	100%

² Data from the STEP study used here are economic potential based on an SO₂-only cost-adder scenario.

Commercial Electric Energy Efficiency Demand Potential by End-Use and Study

	CT (adj)	NY	WI STEP
Lighting	41%	45%	46%
Air Conditioning		40%	42%
Space Heat	38%	0%	0%
Ventilation		2%	2%
Refrigeration	7%	3%	1%
Other	14%	10%	9%
	100%	100%	100%

Commercial Gas Energy Efficiency Savings Potential by End-Use and Study

	OR (climate adjusted)	OR (climate adj., no shell measures)
Space heating (Equip)	51%	85%
Space heating (Shell)	40%	0%
DHW	8%	14%
Cooking	1%	1%
Other	0%	0%
Total	100%	100%

In the industrial comparison, the results for the Connecticut study are provided in their original form, and as adjusted to account for industrial HVAC and motors differences between WI and CT. The studies show large variation among end-uses, driven as much by differences in study emphasis as industry mix.

Industrial Electric Energy Efficiency Potential by End-Use and Study

	CT	CT (adj)	NY	WI STEP
HVAC	27%	12%	2%	5%
Lighting	11%	12%	37%	12%
Compressed Air	13%	16%	7%	6%
Drying Fans	5%	6%	3%	20%
Other Motors	15%	19%	4%	34%
Pumping	19%	24%	11%	4%
Refrigeration	1%	1%	2%	13%
Other	10%	11%	34%	6%
	100%	100%	100%	100%

Industrial Electric Energy Efficiency Demand Potential by End-Use and Study

	CT	CT (adj)	NY	WI STEP
HVAC	4%	3%	2%	7%
Lighting	10%	9%	43%	14%
Compressed Air	20%	22%	6%	7%
Drying Fans	7%	7%	2%	13%
Other Motors	10%	11%	3%	37%
Pumping	28%	31%	9%	4%
Refrigeration	1%	1%	2%	14%
Other	20%	15%	31%	3%
	100%	100%	100%	100%

Industrial Gas Energy Efficiency Savings Potential by End-Use and Study

	Puget LCP
HVAC	15%
Process Boiler - Upgrade/Controls/Heat Recovery	23%
Process Boiler - O&M	15%
Process Boiler - Steam Distribution System	46%
Total	100%

3. Residential Sector Benchmarking Overview

To estimate the extent to which the 15 residential markets proposed in November for the potential study cover the total achievable potential for the Wisconsin residential energy efficiency sector, we benchmarked these markets against several recent potential studies. These included:

- A 2003 study of achievable electric energy and demand potential for New York State, conducted for the New York State Energy Research and Development Authority (NYSERDA);
- A 2004 study of achievable electric energy potential in Connecticut;
- A 2004 study of achievable gas energy potential for a Utah gas utility.

The criteria for selecting these studies were that: (a) they involved estimates of achievable potential—albeit generally without funding constraints; and (b) they were in climate regions where the housing and equipment stock could be considered to be reasonably comparable to Wisconsin's. We also included a recent California potential study and the prior Wisconsin Statewide Technical and Economic Potential (STEP) study in a more limited analysis of how various studies have allocated potential across residential end uses.

The analysis involved mapping the proposed Wisconsin study markets to measures and end-uses defined for the studies, adjusting potential estimates for differences in climate and a few key end-use saturations, and in one case (NYSERDA) adjusting the assumed achievable penetration of retrofit measures. While the process cannot be considered to be an exact one, it does provide at least a rough sense of how the proposed Wisconsin markets stack up against potential estimates from other studies.

In general, the results suggest that the 15 residential markets proposed in November cover about 75 to 85 percent of the achievable potential, depending on the study and whether electric energy, electric demand or gas energy savings are considered.

The analysis showed no clear omissions from the current list of markets that would substantially improve the study coverage given a constraint of 15 residential markets—especially considering the need for the Wisconsin study to balance competing priorities for electric system and gas system improvements.

We also examined the impact on coverage of making changes suggested by WECC in its comments on the November list of proposed residential markets. WECC recommended dropping the two rental-sector refrigerator purchase markets and the 1-4 rental remodeling market, and substituting instead dehumidifier purchase and early retirement, homeowner shell retrofits not associated with remodeling, and fuel switching for rental buildings.

This assessment was more difficult, since it required parsing estimated potential for remodeling versus non-remodeling shell improvements and fuel switching impacts, neither of which were explicitly built into the studies we reviewed. Nonetheless, the results of our assessment suggest that making these changes would result in at least a modest increase in coverage by the proposed study. Since these changes are also favored by WECC as the current Residential Program Administrator for Focus on Energy, we recommend that these substitutions be made. The final list of proposed residential markets is provided in Appendix C.

In the following sections, we provide more detail about our analysis of the individual studies.

NYSERDA

We used the NYSERDA study's 10-year achievable Greenhouse Gas (GHG) potential estimates for benchmarking against the proposed Wisconsin study. The achievable GHG scenario is not really *achievable* in the sense of being grounded in program implementation scenarios. Rather, it is something more akin to theoretical maximum achievable potential, in that it recognizes market barriers to fully achieving technical or economic potential, but does not involve program spending constraints. The report acknowledges this perspective and notes the estimates are not to be used for explicit program planning.

The achievable GHG scenarios in the NYSERDA study generally assumes fairly high market shares for incremental markets, on the order of 75 percent or more for many markets. The scenario also assumes a very high penetration of retrofit opportunities: roughly a quarter of all households would be visited and have all applicable measures installed in a ten-year time frame under the achievable GHG scenario.

We felt that an adjustment to the estimated potential from retrofit measures was needed to bring these estimates more in line with what could realistically be achieved through actual program efforts. We therefore divided potential estimates for retrofit measures by five. Note that this would still imply installing all applicable measures in about five percent of Wisconsin homes over a 10-year period, or approximately 10,000 homes per year.

We also used Census 2000 data to adjust for the much larger proportion of multifamily housing in New York (particularly large multifamily buildings in and around New York City). New York housing is about evenly divided between multifamily housing and single-family housing; Wisconsin housing on the other hand is about three-quarters single-family.

Finally, we also made minor adjustments to potential estimates from heating- and cooling-related measures, since Wisconsin's climate has somewhat more heating degree days (and fewer cooling degree days) than New York's.

Volume 7 of the NYSERDA report contains a large table (Table 7.1.1) that lists the 10-year kWh and summer peak kW potential for each measure in each sector and subsector. The measures are divided by market type (retrofit, incremental purchase, and new construction), and for residential are also divided between single-family and multifamily.

For the residential sector analysis, we extracted the residential estimates from the table, discarding measures related to air-source heat pumps, which are rare in Wisconsin. This yielded a list of 302 line items across measures markets and subsector (single-family/multifamily).

We then mapped the 15 proposed markets for the Wisconsin study to these items (see Appendix B). Given the detailed data available from the NYSERDA report, this was relatively straightforward—with one exception. The three remodeling markets proposed for the Wisconsin study could not be directly mapped to the NYSERDA list. Residential remodeling typically involves retrofit shell improvements, appliance purchases, and mechanical system replacements. As an approximation, we included half of the estimated potential for shell improvements, dishwasher replacement, and lighting fixture and control retrofits under the remodeling markets.

Adjusted and mapped in this way, the NYSERDA study suggests that the November-proposed Wisconsin markets account for 74 percent of electric energy impacts and 86 percent of electric demand impacts, as the tables below show.

Estimated proportion of NYSERDA potential covered by proposed Wisconsin markets

Proposed Wisconsin market		% of NYSERDA Potential	
		Energy	Demand
16	Homeowner/renter electronic appliance purchase (TV, computer, etc.)	18%	6%
17/18	retail lighting purchase (homeowner, renter, and rental common area)	15%	2%
19	Homeowner furnace replacement	4%	<1%
20	Homeowner AC purchase	9%	57%
21	Rental heating system replacement	1%	<1%
22	Homeowner/renter retail room AC purchase	2%	10%
23	Homeowner water heater replacement	3%	1%
24	New homes, single-family, owner occupied	6%	4%
25	Homeowner remodeling	4%	<1%
26/27	Rental remodeling	1%	<1%
29	Homeowner washer purchase	11%	5%
28/30	Rental refrigerator purchase	1%	<1%
Total		74%	86%

Proposed Wisconsin Study Coverage of NYSERDA Residential End-Uses

	% of NYSERDA Achievable Potential		Estimated end-use coverage by proposed WI markets		Overall WI study coverage	
	Energy	Demand	Energy	Demand	Energy	Demand
Lighting	25%	4%	75%	75%	19%	3%
Electronic Appl.	18%	6%	100%	100%	18%	6%
Clothes washers	12%	5%	89%	89%	10%	5%
Central AC	10%	65%	89%	90%	9%	59%
Space heating	9%	0%	81%	78%	7%	0%
Fans	7%	1%	12%	13%	1%	0%
Refrigerators	5%	2%	16%	16%	1%	0%
Water heating	5%	2%	61%	61%	3%	1%
Building shell	3%	0%	50%	50%	1%	0%
Dishwashers	2%	1%	94%	94%	2%	1%
Room AC	2%	10%	95%	95%	2%	9%
Well pumps	1%	0%	0%	0%	0%	0%
New Construction	1%	2%	94%	96%	0%	2%
Pools	0%	0%	13%	13%	0%	0%
Waterbeds	0%	0%	0%	0%	0%	0%
Exit lighting	0%	0%	0%	0%	0%	0%
Dehumidifiers	0%	1%	0%	0%	0%	0%
Ventilation equip.	0%	0%	0%	0%	0%	0%
Total	100%	100%			74%	86%

The table below shows the measures and end-uses *not* covered by the November-proposed 15 markets for the Wisconsin study:

**Proposed Wisconsin Study Coverage of NYSERDA Residential End-Uses—
Excluded Measures**

NYSERDA Measures not included in WI markets	% of NYSERDA Potential	
	Energy	Demand
Ceiling fan purchase	4%	1%
Other lighting measures	2%	<1%
Refrigerator purchase upgrade (single-family)	2%	1%
Additional heating system and distribution measures	2%	<1%
Lighting fixture replacement not included in remodeling	2%	<1%
Refrigerator early retirement	2%	1%
Exhaust fan purchase	2%	1%
Additional clothes washer measures	1%	1%
Shell retrofits not included in remodeling	1%	<1%
Water heater upgrade to heat pump	1%	1%
Floor and table lamps	1%	<1%
Additional CAC measures	1%	6%
Retrofit CFLs	1%	<1%
Well-pump related measures	1%	<1%
All other measures	3%	2%
Total	26%	14%

WECC recommended removing three markets:

- 1-4 unit rental remodeling (#26)
- 1-4 unit rental refrigerator replacement (#38)
- 5+ unit rental refrigerator purchase (#30)

and replacing them with the following three markets:

- Dehumidifier early replacement and upgrade on purchase
- Homeowner shell retrofits (not associated with remodeling)
- Rental building fuel switching

The above analysis suggests that this switch would have only a small impact on the potential coverage by the Wisconsin study. None of the proposed deletions or replacements make up more than a percent or two of the potential from the NYSERDA study (although fuel switching was apparently not considered by the study).

However the NYSERDA measures do not map perfectly to these markets. For example, for dehumidifiers, the NYSERDA study includes early retirement, but not purchase upgrades. Also, space-heating related markets, such as shell retrofits, tend to represent a smaller proportion of electric potential than gas potential, which was not considered by the NYSERDA study. On balance, our sense from the NYSERDA data is that making the proposed changes would increase the Wisconsin study coverage somewhat.

Connecticut

The Connecticut study examined 10-year maximum achievable potential using a bottom-up measure approach for the residential sector. Appendix B of the report provides a detailed listing of the residential measures, along with the estimated electric energy savings potential. We estimated the degree to which the proposed Wisconsin study markets covered each of the CT study measures (see Attachment), excluding from the analysis resistance electric space heat, air-source heat pumps and solar water heaters. We also adjusted cooling measures for the difference in population-weighted cooling degree days between Wisconsin and Connecticut.

The table below shows our estimate of the degree to which the proposed WI markets cover the CT study potential, by end-use category. Overall, the analysis suggests that the November-proposed residential markets for the Wisconsin study will cover 80 percent of the potential identified for Connecticut. Note that electronic appliances were not included in the CT study, but are a proposed market for the WI study.

Proposed Wisconsin Study Coverage of CT Residential Measures

Measure category	% of CT Study Maximum Achievable Potential ^a	WI study coverage of measure category	Overall WI study coverage
Lighting (CFLs)	53%	100%	53%
Water Heating	23%	66% ^b	15%
Clothes Dryer ^c	5%	100%	5%
Central AC ^d	4%	55% ^e	2%
Refrigerator	4%	25% ^f	1%
Clothes Washer	2%	100%	2%
Pool	2%	0%	0%
Dishwasher	2%	0%	0%
Room AC ^b	1%	100%	1%
Misc.	1%	0%	0%
Freezer	1%	0%	0%
	100%		80%

^aExcludes electric resistance heating and air-source heat pump measures.

^bThe proposed WI study markets cover water heater purchase upgrades but not retrofits such as pipe insulation.

^cAppears to be electric dryer savings from installation of efficient clothes washers that remove more moisture from laundry.

^dThis category includes purchase upgrades, shell retrofits to reduce AC load, cooling alternatives, such as ceiling fans, and the construction of new homes. Potential estimates adjusted for cooling degree day difference between Wisconsin and Connecticut.

^eProposed WI study coverage includes CAC purchase upgrades, new home construction, and 50% of shell retrofit upgrades.

Does not include duct measures, thermostats, or cooling alternatives such as ceiling fans.

^fProposed WI study coverage assumes that 25% of refrigerator sales are for rental housing.

Retrofit measures for electric water heaters (tank wrap, showerheads, and pipe insulation) represent the single largest category (8 percentage points) not covered by the November-proposed WI markets. (Note that the 27 percent reported saturation of electric water heaters for the CT study is the same as that for Wisconsin.) This is followed by refrigerator upgrades and early retirement in markets other than the proposed rental markets for the WI study, which account for 4 percentage points of potential not covered by the Wisconsin study. It does not appear that the CT study considered secondary refrigerator turn in as a measure.

Making the three WECC-recommended changes would have a slight positive impact on the Wisconsin study coverage in terms of electric impacts based on the CT study. This stems from removing approximately 1 percentage point of potential represented by the two rental-sector refrigerator markets, a net gain of less than a percentage point from removing 1-4 unit rental remodeling but adding homeowner shell retrofits not associated with remodeling, and an unknown (but positive) impact from adding rental-sector fuel switching.

Utah

The Utah study examined 10-year technical and maximum achievable potential for 10 natural gas measures (the study also included low-income weatherization, which we excluded from our analysis). The table below shows the contribution of each of these measures to the estimated potential (after adjusting for the difference in heating degree days between Wisconsin and Utah and for the difference in saturation of gas water heaters), along with our estimates of how the proposed Wisconsin markets cover these

measures. As with the other studies, we assumed that the Wisconsin remodeling markets account for about half of shell upgrade savings potential.

Proposed Wisconsin Study Coverage of Utah Residential Measures

	% of Utah Study Maximum Achievable Potential ^a	Estimated WI study coverage of measure category	Overall WI study coverage
Thermostat ^b	4%	0%	0%
Water heater blanket ^b	3%	0%	0%
Clothes Washer (electric dryer)	2%	100%	2%
Clothes Washer (gas dryer)	1%	100%	1%
Windows ^b	5%	50%	3%
Gas Furnace upgrade	13%	100%	13%
Gas Water heater upgrade	4%	100%	4%
Weatherization	34%	50%	17%
New construction	34%	100%	34%
Total	100%		74%

^aExcludes Low-income category.
^bEstimates are for do-it-yourself installations.

Overall, the data suggest that the proposed Wisconsin markets will cover about three quarters of the maximum achievable potential. Note that the Utah study does not appear to have considered multifamily heating system replacements, which are included in the proposed Wisconsin study.

At the same time, the Wisconsin potential from furnace upgrades is probably less than indicated from the Utah study. Data from the Gas Appliance Manufacturer's Association shows the Year 2000 market share for high efficiency furnaces for Wisconsin as 73%, compared to 25% for Utah. Also, the Utah potential for new construction may be overstated: The Utah report is based on savings of about 50 percent, much higher than the documented gas savings from the Wisconsin Energy Star Homes program of about 10 percent.

The most significant measures not covered by the Wisconsin markets are shell upgrades (from weatherization and window replacement) not accounted for by remodeling markets (which we assumed to account for half of the potential), as well as water heater retrofits and setback thermostat installations.

Making the WECC-recommended changes would result in an increase in the Wisconsin study coverage vis a vis the Utah study—if the increase in gas consumption from the proposed rental fuel-switching measure (which is intended as an electric system measure) is not counted. Dropping the two rental refrigerator markets and adding the dehumidification market have no impact on gas coverage. But while dropping 1-4 unit remodeling (which constitutes less than 10 percent of shell retrofit potential by our estimation) decreases the gas coverage, *adding* non-remodeling homeowner shell retrofits (which we estimate at more than 30 percent of the total shell retrofit potential) increases

the coverage. The net impact based on the Utah study data and our assessment of remodeling/non-remodeling shell retrofit potential suggests an increase of more than 10 percentage points from making these changes.

End-Use Comparison

As an overall comparison, we examined how the potential estimated for the various breaks out by major end-use. For this comparison, we added two additional studies: (1) the 1995 Wisconsin Statewide Technical and Economic Potential study, and (2) a 2002 California potential study. Although the prior Wisconsin study does not address achievable potential, it is a local potential study that provides potential estimates by end-use.³ The California study is included here because it provides estimates of achievable potential by major end-use—though not in enough detail for the mapping exercise conducted for the studies above. As with the other studies, potential estimates for the California study are adjusted for climate differences (as well as for the saturation of electric water heaters in this case).

The tables below show how electric energy, electric demand, and gas savings potential break out by end-use for each study. Comparisons are tricky, because the studies did not all consider the same end uses; in particular, only the NYSERDA study included home electronics, which it estimated to contain a non-trivial proportion of potential savings.

Residential Electric Energy Potential by End-Use and Study

	CA	CT	NY	WI STEP
Space heating	a	a	9%	11%
Space cooling	3%	6%	15%	5%
Water heating ^b	9%	33%	18%	43%
Dehumidification	a	a	<1%	0%
Lighting	53%	53%	25%	0%
Refrigeration	22%	5%	5%	31%
Home electronics	a	a	18%	a
Other	13%	3%	9%	11%
Total	100%	100%	100%	100%

^aEnd-use not included in study.

^bAlso includes savings from clothes washing and dishwashers.

³ Data from the STEP study used here are economic potential based on an SO2-only cost-adder scenario.

Residential Electric Demand Potential by End-Use and Study

	CA	NY	WI STEP
Space heating	^a	0%	0%
Space cooling	37%	78%	30%
Water heating ^b	11%	8%	21%
Dehumidification	^a	1%	11%
Lighting	28%	4%	0%
Refrigeration	17%	2%	29%
Home electronics	^a	6%	A
Other	7%	2%	9%
Total	100%	100%	100%

^aEnd-use not included in study.

^bAlso includes savings from clothes washing and dishwashers.

Residential Gas Savings Potential by End-Use and Study

	CA	UT
Space heating	70%	91%
Water heating ^b	30%	9%
Total	100%	100%

^bAlso includes savings from clothes washing and dishwashers.

Nonetheless, we can make some observations from these comparisons:

- With the notable exception of the Wisconsin STEP study, all of the studies place lighting as the top candidate in terms of total electric energy potential. (That the STEP study found exactly zero potential for home lighting suggests that it was based on replacement costs that are now outmoded.)
- Electric water heating (combined with clothes and dish washing) represents a non-trivial proportion of electric potential for all studies, but the percentage varies considerably. The Wisconsin STEP study places this end-use higher than any other study, but probably because it was the only study to consider fuel switching.
- The studies fall into two camps with regard to refrigeration: two show a significant amount of potential (the Wisconsin STEP study and the CA study), and two consider refrigeration to be less important (NY and CT). Differences probably are due to varying assumptions in the ability to achieve early replacement of older refrigerators and persuade homeowners to retire secondary refrigerators.
- Not surprisingly, all three studies with electric demand estimates place air conditioning as the top candidate for demand savings potential.
- Also, not surprisingly, the two studies that looked at gas savings attributed the majority of savings potential to space heating, though they differ in the percentage assignment.

Appendix A

Description of Proposed Commercial and Industrial Markets

Presentation of the original methodology (11/1/2004) resulted in requests for changing the following markets:

Suggested C&I Market Changes		
Sector	Market type	Market
Commercial & Industrial	New construction	Component efficiency improvements (excl. industrial process)
Commercial & Industrial	New construction	Whole-building integrated design (excl. industrial process)
Commercial	Incremental	Alterations of commercial spaces
Commercial	Retrofit	Lighting & controls in large commercial, education, and government

Based on the screening exercise and input from stakeholders, we recommend the following adjustments to the original markets:

Recommended C&I Market Changes		
Sector	Market type	Market
Commercial & Industrial	New construction	High performance building design and construction (excl. industrial process)
Commercial & Industrial	Incremental	Lighting potential lost opportunity markets (remodel, equipment replacement)
Commercial & Industrial	Retrofit	Lighting & lighting controls retrofit
Industrial	Incremental	Motor end of service repair & replacement

The changes amount to combining the two New Construction markets into a single market so that the industrial motor end of service replacement market could be added, adding lighting replacement to the commercial alterations (lighting remodeling) and expanding to include industrial, and adding industrial to the commercial lighting retrofit market. The proposed set of 15 commercial and industrial markets is provided below.

New Proposed C&I Markets			
#	Sector	Market type	Statewide Potential Study Market
1	Commercial & Industrial	New construction	High performance building design and construction (excl. industrial process)
2	Commercial & Industrial	Incremental	Unitary HVAC end of service replacement
3	Commercial & Industrial	Incremental	Lighting potential lost opportunity markets (remodel, equipment replacement)
4	Commercial	Incremental	Commercial boiler (>300,000 Btuh) system improvements
5	Commercial & Industrial	Retrofit	Lighting & lighting controls retrofit
6	Commercial	Retrofit	Chiller system improvements
7	Commercial & Industrial	Retrofit	Small HVAC system maintenance
8	Commercial	Retrofit	Supermarket and packaged refrigeration
9	Industrial	Incremental	Motor end of service repair & replacement
10	Industrial	Retrofit	Compressed air system optimization
11	Industrial	Retrofit	Fan system optimization
12	Industrial	Retrofit	Pump system optimization
13	Industrial	Retrofit	Manufacturing process retrofits
14	Municipal	Retrofit	Water/wastewater operations
15	Agricultural	Retrofit	Dairy, Ag fans, and Ag pumps

The scope of each of the proposed 15 commercial and industrial markets is outlined below.

Commercial & Industrial High-Performance New Construction

- Includes High Performance Building Design and Construction, a medium path between state-of-the-art sustainable construction and simple component substitutions, encompassing many measures of whole-building design, but widely adoptable.

Commercial & Industrial Packaged HVAC Equipment End of Service Replacement

- The market includes unitary HVAC equipment replaced at the time of failure of the existing unit
- We expect that savings/cost will be weighted by population tonnage (3, 7.5, 15, 25 tons) for increasing efficiency of the replacement unit to Consortium for Energy Efficiency Tier 2.

Commercial boiler (>300,000 Btuh) system improvements

- Includes replacement for gas fired boilers over 300,000 Btuh mainly in health, education, and offices
- Also includes controls and commissioning measures of temperature reset, tune-up, steam balance, and vent dampers.
- Replacement size up to approximately 3,000,000 Btuh

Commercial and & Industrial Lighting Incremental Upgrade Opportunities

- Includes commercial remodeling market, and replacement of fluorescent and HID lighting equipment that has reached the end of service life.

Commercial and Industrial Lighting and Controls Retrofit

- Includes market potential for a comprehensive lighting retrofit of commercial and industrial fluorescent, HID, and incandescent lighting to best available source.
- Would include LED exit signs
- Study will be careful to exclude incremental lighting upgrades from the market so there is no double-counting.

Commercial Chiller system improvements

- Chiller system optimization to accommodate both improved controls and cooling tower measures, and improved chiller efficiency if replacement is included
- Does not include optimization of ventilation.

Commercial and Industrial Small HVAC system maintenance

- This is a market to improve the operating efficiency of in-place unitary HVAC equipment, by measures that could include: fixing economizer controls, adding new economizers, damper repair, coil cleaning, refrigerant charge, and other controls.
- Includes measures that impact gas heating and electric cooling

Commercial Supermarket and Packaged Refrigeration

- Grocery store: display cases, central refrigeration mechanical & control
- Packaged stand alone refrigeration
 - Solid-door and open reach-in refrigerators and freezers
 - Beverage merchandisers
 - Ice-makers

Industrial Motor End of Service Repair & Replacement

- Includes the energy savings potential for efficiency upgrade from EPACT standards to NEMA premium efficiency motors
- Market intervention would encompass motor management and downsizing when appropriate
- Intervention would also encompass improvements in rewind practices for failed motors

Industrial Compressed Air System Optimization

- Includes a range of best practices measures
- Use market studies to encompass measures including leak detection and repair, reduce system pressure, eliminating inappropriate uses, variable inlet volume or VSD controlled screw compressors, and properly sized and controlled compressor

Industrial Fan System Optimization

- Includes a range of best practices measures
- Use market studies to encompass measures including electronic adjustable speed drives, efficient motors, sizing, maintenance, and airflow.

Industrial Pump System Optimization

- Includes a range of best practices measures
- Use market studies to encompass measures including electronic adjustable speed drives, efficient motors, sizing, maintenance, and flow.

Manufacturing Process Retrofits

- Will work with Stakeholders to select a limited number of process technologies that represent the best near term opportunities for conversion
- Paper industry (several measures), food (ammonia refrigeration), and steam system distribution best practices are the candidate measure categories.

Water treatment/supply

- Includes a range of best practices measures
- Use market studies to encompass measures including electronic adjustable speed drives, aeration measures, motors, sizing, and maintenance.

Agriculture

- Dairy will use a single savings number representative of a package of measures
- Will work with Stakeholders to estimate fan (livestock) and pump (non-dairy) savings

Appendix B

Mapping of NYSERDA Study Measures to Wisconsin Study Markets

Proposed WI Res. Market	NYSERDA measure (from Table 7.1.1)
16 (Electronic appliance purchase)	Res Computer_CPU power supply MF misc retail Res Computer_CPU power supply SF misc retail Res Computer_CRT monitor power supply MF misc retail Res Computer_CRT monitor power supply SF misc retail Res Computer_LCD computer monitor MF misc retail Res Computer_LCD computer monitor SF misc retail Res Copier_Energy Star upgrades MF misc retail Res Copier_Energy Star upgrades SF misc retail Res Fax_Energy Star upgrades MF misc retail Res Fax_Energy Star upgrades SF misc retail Res Laser_Energy Star upgrades (LBL Tier 1) SF misc retail Res Laser_Energy Star upgrades MF misc retail Res Laser_power supply upgrade (LBL Tier 2) SF misc retail Res Laser_power supply upgrade MF misc retail Res MiscPower_low-wattage power supplies MF misc retail Res MiscPower_low-wattage power supplies SF misc retail Res TVs_Energy Star stand-by upgrade <= 1 watt MF T_V_ retail Res TVs_Energy Star stand-by upgrade <= 1 watt SF T_V_ retail Res TVs_Energy Star stand-by upgrade <=3 watts MF T_V_ retail Res TVs_Energy Star stand-by upgrade <=3 watts SF T_V_ retail Res TVs_LCD and power supply upgrades MF T_V_ retail Res TVs_LCD and power supply upgrades SF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 1) MF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 1) SF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 2) MF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 2) SF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 3) MF T_V_ retail Res VCR/DVD_Energy Star upgrade (LBL Tier 3) SF T_V_ retail
17 & 18 (retail lighting purchase)	Res Intlite_torchieres 1.5 hr/day MF lite retail Res Intlite_torchieres 1.5 hr/day SF lite retail Res Intlite_torchieres 2.5 hr/day MF lite retail Res Intlite_torchieres 2.5 hr/day SF lite retail Res Intlite_torchieres <1 hr/day MF lite retail Res Intlite_torchieres <1 hr/day SF lite retail Res Intlite_torchieres > 2.5 hr/day MF lite retail Res Intlite_torchieres > 2.5 hr/day SF lite retail Res Lamps_screw-in CFLs 1.5 hr/day MF lite retail Res Lamps_screw-in CFLs 1.5 hr/day SF lite retail Res Lamps_screw-in CFLs 2.5 hr/day MF lite retail Res Lamps_screw-in CFLs 2.5 hr/day SF lite retail Res Lamps_screw-in CFLs < 1 hr MF lite retail Res Lamps_screw-in CFLs < 1 hr SF lite retail Res Lamps_screw-in CFLs > 2.5 hr/day MF lite retail Res Lamps_screw-in CFLs > 2.5 hr/day SF lite retail Res Nitelite_SSL (LED & luminescent) nightlights MF lite retail Res Nitelite_SSL (LED & luminescent) nightlights SF lite retail
19 (homeowner furnace purchase)	Res FurnFan_Higher efficiency furnace fans SF heat retail

Proposed WI Res. Market	NYSERDA measure (from Table 7.1.1)
20 (homeowner CAC purchase)	Res CAC_1st purchase Energy Star upgrade SEERSF cool retail Res CAC_Correct size/charge/air flow SF cool retail Res CAC_Upgrade SEER 13 to 14 SF cool retail Res CAC_Upgrade SEER 14 to 15 SF cool retail Res CAC_Upgrade SEER 15 to 16 SF cool retail
21 (multifamily htg. sys. replace.)	Res FurnFan_Higher efficiency furnace fans MF heat retail
22 (room AC purchase)	Res WAC_1st purchase Energy Star upgrade EER SF cool retail Res WAC_1st purchase Energy Star upgrade to EEMF cool retail Res WAC_Upgrade EER 10.7 to 11.5 SF cool retail Res WAC_Upgrade EER 11.5 to 12.5 SF cool retail Res WAC_Upgrade EER 12.5 to 13.5 SF cool retail Res WAC_Upgrade to EER 11.5 MF cool retail Res WAC_Upgrade to EER 12.5 MF cool retail Res WAC_Upgrade to EER 13.5 MF cool retail
23 (homeowner DHW replacement)	Res DHW_Upgrade to heat pump water heater SF hwtr retail
24 (single-family new construction)	Res BldgEtc_Upgrade to 86 points SF H_P_ RNC Res BldgEtc_Upgrade to 86 points SF cool RNC Res BldgEtc_Upgrade to 88 points SF H_P_ RNC Res BldgEtc_Upgrade to 88 points SF cool RNC Res BldgEtc_Upgrade to 90 points SF H_P_ RNC Res CAC_Correct size/charge/air flow MF cool RNC Res CAC_Correct size/charge/air flow SF cool RNC Res C_Washer_Upgrade to Energy Star 1.7 MF wash RNC Res C_Washer_Upgrade to Energy Star 1.7 SF wash RNC Res CeilFan_upgrade to Energy Star MF lite RNC Res CeilFan_upgrade to Energy Star SF lite RNC Res D_Washer_upgrade to Energy Star MF dish RNC Res D_Washer_upgrade to Energy Star SF dish RNC Res ExhstFan_upgrade to Energy Star SF misc RNC Res FurnFan_Higher efficiency furnace fans SF heat RNC Res Intlite_high performance fixtures 1.5 hr/day SF lite RNC Res Intlite_high performance fixtures 2.5 hr/day SF lite RNC Res Intlite_high performance fixtures <1 hr/day SF lite RNC Res Intlite_high performance fixtures > 2.5 hr/day SF lite RNC Res Intlite_high performance fixtures > 2.5 hr/day SF lite RNC Res OutLite_high performance fixtures 1.5 hr/day SF lite RNC Res OutLite_high performance fixtures 2.5 hr/day SF lite RNC Res OutLite_high performance fixtures <1 hr/day SF lite RNC Res OutLite_high performance fixtures >2.5 hr/day SF lite RNC Res P_Fridge_upgrade to 1kWh per day SF frdg RNC Res P_Fridge_upgrade to Energy Star SF frdg RNC Res PoolTub_High-efficiency motor if >1HP SF pool RNC Res PoolTub_Pump timers SF pool RNC Res Well_Upgrade well-water pump SF hwtr RNC
25 (homeowner remodeling) (50% of potential assumed)	Res D_Washer_early retirement of existing for EnerSF dish retrofit Res ESH_Install new high performance windows SF heat retail Res ESH_Install new high performance windows SF heat retrofit Res ESH_Install storm windows SF heat retrofit Res ESH_Insulate attic SF heat retrofit Res ESH_Insulate walls SF heat retrofit Res ESH_New controls such as programmable t-staSF heat retail

Proposed WI Res. Market	NYSEDA measure (from Table 7.1.1)
	Res ESH_Seal by-passes SF heat retrofit Res IntLite_high performance fixtures 1.5 hr/day SF lite retail Res IntLite_high performance fixtures 1.5 hr/day SF lite retrofit Res IntLite_high performance fixtures 2.5 hr/day SF lite retail Res IntLite_high performance fixtures 2.5 hr/day SF lite retrofit Res IntLite_high performance fixtures <1 hr/day SF lite retail Res IntLite_high performance fixtures <1 hr/day SF lite retrofit Res IntLite_high performance fixtures > 2.5 hr/day SF lite retail Res IntLite_high performance fixtures > 2.5 hr/day SF lite retrofit Res OutLite_controls; e.g., timers, photocells, motioSF lite retail Res OutLite_controls; e.g., timers, photocells, motioSF lite retrofit Res OutLite_high performance fixtures 1.5 hr/day SF lite retail Res OutLite_high performance fixtures 1.5 hr/day SF lite retrofit Res OutLite_high performance fixtures 2.5 hr/day SF lite retail Res OutLite_high performance fixtures 2.5 hr/day SF lite retrofit Res OutLite_high performance fixtures <1 hr/day SF lite retail Res OutLite_high performance fixtures <1 hr/day SF lite retrofit Res OutLite_high performance fixtures >2.5 hr/day SF lite retail Res OutLite_high performance fixtures >2.5 hr/day SF lite retrofit
26 & 27 (rental remodeling) (50%) of potential assumed	Res D_Washer_1st purchase Energy Star upgrade MF dish retail Res D_Washer_early retirement of existing for EnerMF dish retrofit Res ESH_Install new high performance windows MF heat retail Res ESH_Install new high performance windows MF heat retrofit Res ESH_Install storm windows MF heat retrofit Res ESH_Insulate attic MF heat retrofit Res ESH_Insulate walls MF heat retrofit Res ESH_New controls such as programmable t-staMF heat retail Res ESH_Seal by-passes MF heat retrofit Res IntLite_T-8, specular reflector, tandem wiring a MF lite RNC Res IntLite_T-8, specular reflector, tandem wiring a MF lite retail Res IntLite_T-8, specular reflector, tandem wiring a MF lite retrofit Res IntLite_high performance fixtures 1.5 hr/day MF lite retail Res IntLite_high performance fixtures 1.5 hr/day MF lite retrofit Res IntLite_high performance fixtures 2.5 hr/day MF lite RNC Res IntLite_high performance fixtures 2.5 hr/day MF lite retail Res IntLite_high performance fixtures 2.5 hr/day MF lite retrofit Res IntLite_high performance fixtures <1 hr/day MF lite RNC Res IntLite_high performance fixtures <1 hr/day MF lite retail Res IntLite_high performance fixtures <1 hr/day MF lite retrofit Res IntLite_high performance fixtures > 2.5 hr/day MF lite RNC Res IntLite_high performance fixtures > 2.5 hr/day MF lite retail Res IntLite_high performance fixtures > 2.5 hr/day MF lite retrofit Res OutLite_controls; e.g., timers, photocells, motioMF lite RNC Res OutLite_controls; e.g., timers, photocells, motioMF lite retail Res OutLite_controls; e.g., timers, photocells, motioMF lite retrofit Res OutLite_high performance fixtures 1.5 hr/day MF lite RNC Res OutLite_high performance fixtures 1.5 hr/day MF lite retail Res OutLite_high performance fixtures 1.5 hr/day MF lite retrofit Res OutLite_high performance fixtures 2.5 hr/day MF lite RNC Res OutLite_high performance fixtures 2.5 hr/day MF lite retail Res OutLite_high performance fixtures 2.5 hr/day MF lite retrofit

Proposed WI Res. Market	NYSERDA measure (from Table 7.1.1)
	Res OutLite_high performance fixtures <1 hr/day MF lite RNC
	Res OutLite_high performance fixtures <1 hr/day MF lite retail
	Res OutLite_high performance fixtures <1 hr/day MF lite retrofit
	Res OutLite_high performance fixtures >2.5 hr/day MF lite RNC
	Res OutLite_high performance fixtures >2.5 hr/day MF lite retail
	Res OutLite_high performance fixtures >2.5 hr/day MF lite retrofit
29 (homeowner washer purchase)	Res C_Washer_Upgrade to Energy Star 1.7 SF wash retail
	Res D_Washer_1st purchase Energy Star upgrade SF dish retail
28 & 30 (rental refrigerator purchase)	Res P_Fridge_1 kWh/day refrigerator MF frdg retail
	Res P_Fridge_1st purchase Energy Star upgrade MF frdg retail

Wisconsin study coverage of CT study measures

End Use Category	Measure ID	Measure	Estimated WI Study Coverage
Air-to-Air Heat Pump	51	HE Eff Air to Air Heat Pump	Exclude
Air-to-Air Heat Pump	52	Ceiling R-0 to R-19 Insulation-Batts	Exclude
Air-to-Air Heat Pump	53	Ceiling R-7 to R-19 Insulation-Batts	Exclude
Air-to-Air Heat Pump	54	Ceiling R-19 to R-38 Insulation-Batts	Exclude
Air-to-Air Heat Pump	55	Floor R-0 to R-19 Insulation-Batts	Exclude
Air-to-Air Heat Pump	56	Wall 2x4 R-0 to Blow-In R-13 Insulation	Exclude
Air-to-Air Heat Pump	57	Insulating window treatments	Exclude
Air-to-Air Heat Pump	58	Skylight shades	Exclude
Air-to-Air Heat Pump	61	Air sealing	Exclude
Central AC	25	10 to 12 SEER Split-System Air Conditioner	100%
Central AC	26	12 to 13 SEER Split-System Air Conditioner, TXV	100%
Central AC	27	13 to 14 SEER Split-System Air Conditioner, TXV	100%
Central AC	28	Programmable Thermostat	0%
Central AC	29	Ceiling Fans	0%
Central AC	30	Whole House Fans	0%
Central AC	31	Attic Venting - Power Venting	0%
Central AC	32	Basic HVAC Diagnostic Testing And Repair	100%
Central AC	33	Duct Repair	0%
Central AC	34	Duct Insulation	0%
Central AC	35	Default Window With Sunscreen/Awning	50%
Central AC	36	Double Pane Clear Windows to Double Pane, Med	50%
Central AC	37	Ceiling R-7 to R-19 Insulation-Batts	50%
Central AC	38	Ceiling R-19 to R-38 Insulation-Batts	50%
Central AC	39	Floor R-0 to R-19 Insulation-Batts	50%
Central AC	40	Skylight shades	50%
Central AC	41	Infiltration Reduction	50%
Central AC	62	Energy Star New Homes	100%
Central AC	64	8 to 12 EER Split-System Air Conditioner - Early	100%
Clothes Dryer	10	HE Clothes Dryer (EF=.52)	0%
Clothes Dryer	68	SEHA CW Tier 2 (EF=3.25) ELECTRIC DRYER	100%
Clothes Washer	9	SEHA CW Tier 2 (EF=3.25)	100%
Dishwasher	12	Energy Star DW (EF=0.58)	0%
Dishwasher	66	Energy Star DW (EF=0.58) - EWH Savings	0%
Freezer	2	HE Freezer	0%
Freezer	65	HE Freezer - Early Replacement	0%

End Use Category	Measure ID	Measure	Estimated WI Study Coverage
Lighting	16	14 Watt CFL, .5 Hrs/Day	100%
Lighting	17	14 Watt CFL, 2.5 Hrs/Day	100%
Lighting	18	14 Watt CFL, 6 Hrs/Day	100%
Lighting	19	19 Watt CFL, .5 Hrs/Day	100%
Lighting	20	19 Watt CFL, 2.5 Hrs/Day	100%
Lighting	21	19 Watt CFL, 6 Hrs/Day	100%
Lighting	22	27 Watt CFL, .5 Hrs/Day	100%
Lighting	23	27 Watt CFL, 2.5 Hrs/Day	100%
Lighting	24	27 Watt CFL, 6 Hrs/Day	100%
Misc.	13	Water bed covers	0%
Misc.	14	Hot tubs	0%
Pool	15	High Efficiency Pool Pump and Motor	0%
Refrigerator	1	HE Refrigerator - Energy Star	10%
Refrigerator	63	HE Refrigerator - Energy Star - Early Replacement	10%
Resistance Heat	43	Heat Pump Space Heater	Exclude
Resistance Heat	44	Ceiling R-0 to R-19 Insulation-Batts	Exclude
Resistance Heat	45	Ceiling R-7 to R-19 Insulation-Batts	Exclude
Resistance Heat	46	Ceiling R-19 to R-38 Insulation-Batts	Exclude
Resistance Heat	47	Floor R-0 to R-19 Insulation-Batts	Exclude
Resistance Heat	48	Wall 2x4 R-0 to Blow-In R-13 Insulation	Exclude
Resistance Heat	49	Insulating window treatments	Exclude
Resistance Heat	50	Skylight shades	Exclude
Resistance Heat	60	Air sealing	Exclude
Room AC	42	HE Room Air Conditioner - EER 10.3	100%
Water Heating	3	Heat Pump Water Heater (EF=2.9)	100%
Water Heating	4	HE Water Heater (EF=0.93)	100%
Water Heating	5	Solar Water Heat	Exclude
Water Heating	6	Low Flow Shower Head	0%
Water Heating	7	Pipe Wrap	0%
Water Heating	8	Water Heater Blanket	0%
Water Heating	67	SEHA CW Tier 2 (EF=3.25) ELECTRIC WATER	100%

Appendix C

Revised List of Proposed Residential Markets

Market #	Type of Market	Market	Description
16	Incremental	Homeowner/renter electronic appliance purchase	This market involves homeowners or renters who are in the market to purchase electronic products such as TVs, computers, etc. Potential estimates will likely primarily involve the promotion of Energy Star labeled alternatives.
17	Incremental	Homeowner/renter retail lighting purchase	This market involves homeowners or renters purchasing light bulbs for existing luminaires in homes and apartments, but may also incorporate efficient luminaire alternatives, such as torchieres. Potential estimates will be based on programmatic approaches to increasing the market share of CFLs. Does not include lighting fixtures for new homes, or those purchased for remodeling projects.
18	Incremental	Rental building common-area lighting purchase	This market involves multifamily building operators who purchase lighting products for common-areas in existing buildings. Potential estimates will be based mainly on the ability to substitute CFLs for existing incandescent bulbs, and LED or electroluminescent upgrade kits for exit signs. Does not include lighting purchased for new buildings or as part of building renovation projects.
19	Incremental	Homeowner furnace replacement	This market involves homeowners purchasing new replacement furnaces. Since most furnace sales in Wisconsin are already high efficiency from a combustion standpoint, potential estimates will concentrate on programmatic approaches to encourage electrically efficient variable-speed models. Does not include systems purchased for new homes.
20	Incremental	Homeowner central AC purchase	This market is defined as homeowners who purchase a new central air conditioning system, either as a new add-on or as a replacement to an existing system. Potential estimates will be based on programmatic options to encourage the purchase of units that are more efficient than the upcoming 2006 SEER-13 federal standard, as well as to encourage installation practices (for all SEER levels) that optimize the performance of new systems. Does not include systems purchased for new homes.

Market #	Type of Market	Market	Description
21	Incremental	Rental heating system replacement	This market is defined as multifamily operators who are seeking to replace existing boilers. Potential estimates will be based on the program options to encourage high efficiency replacements, modular installations, and controls to maximize system performance. Does not include systems purchased for new buildings.
22	Incremental	Homeowner/renter retail room AC purchase	This market is defined as homeowners or renters who purchase a new room air conditioner. Potential estimates will be based on program options meant to encourage upgrading the EER of the unit purchased.
23	Incremental	Homeowner water heater replacement	This market is defined as homeowners who are in the market to replace an existing water heater. Potential estimates will be based on program options to encourage upgrades in the energy factor of the replacement unit, switching from electric to gas, switching from atmospherically vented to power-vented units, and the installation of on-demand units. Does not include systems purchased for new homes.
24	New construction	Single-family, owner occupied	This market embraces the construction of single-family, owner-occupied housing. Potential estimates will be based on program options to encourage more efficient building shells, higher efficiency mechanical systems, efficiency upgrades to appliances, and efficiency upgrades for hard-wired lighting.
25	Incremental	Homeowner remodeling	This market involves homeowners undertaking remodeling projects with energy-related aspects. Potential estimates will be based on program options to encourage insulation additions and air sealing during remodeling as well as efficiency upgrades for appliances and lighting purchased for remodeling projects. Does not include mechanical system replacements, as these are covered in other markets.
26*	Incremental/ retrofit	Dehumidifier early retirement and upgrade on purchase	This market involves program approaches to encourage homeowners to upgrade to higher efficiency dehumidifiers, or to retire working but inefficient dehumidifiers. It may also include the promotion of controls to reduce dehumidifier power draw during peak periods.
27	Incremental	5+ unit rental renovation	This market involves remodeling projects undertaken in larger (5+ units) multifamily buildings. Includes shell insulation upgrades and air sealing, as well as appliance replacement and in-

Market #	Type of Market	Market	Description
			unit and common area lighting fixture replacement. Does not include mechanical system replacements.
28*	Retrofit	Homeowner building shell improvements	This market considers program approaches to encourage homeowners to undertake building shell improvements for space heating and cooling savings. It does not cover improvements undertaken as part of home remodeling, which are considered separately in Market #25.
29	Incremental	Homeowner washer purchase	This market is defined as homeowners who purchase a new washing machine.
30*	Retrofit	Rental fuel switching	This market embraces programs to encourage the conversion of rental housing with electric space heating or water heating to gas-fired systems.
* indicates new proposed market for inclusion. These will substitute for 1-4 unit rental remodeling, 1-4 unit rental refrigerator purchase, and 5+ unit refrigerator purchase.			